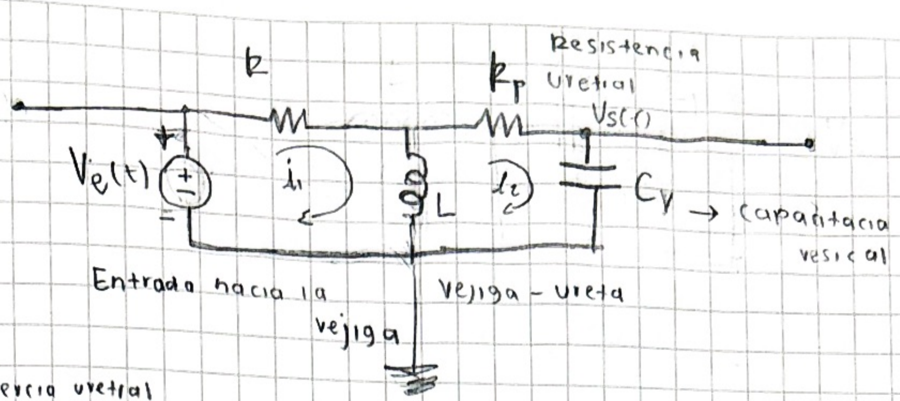


L → inercia uretral

Ecuaciones del circuito

$$Ve(t) = Ri_1 + \left[\frac{L\,d(i_1 - i_2)}{dt}\right]$$

$$\frac{L\,d(i_1 - i_2)}{dt} = R_p i_2 + \frac{1}{Cv}\int i_2\,dt$$

$$Vs(t) = \frac{1}{Cv}\int i_2\,dt$$

A laplace

$$Ve(s) = RI_1 + LSI_1 - LSI_2$$

$$LS(I_1 - I_2) = R_p I_2 + \frac{I_2}{CvS}$$

$$Vs(s) = \frac{I_2}{CS}$$

Para la transformada de fourier

$$LSI_1 - LSI_2 = \left(R_p + \frac{1}{Cs}\right)I_2$$

$$I_1 = \left(R_p + \frac{1}{CS} + LS\right)\frac{I_2}{LS} \rightarrow I_1 = \left(\frac{CSR_p + 1 + CSLS}{CSLS}\right)I_2$$

$$Ve(s) = \left(\frac{RCSR_p + R + RCS^2L}{CS^2L} + \frac{CLS^2R_p + LS + CL^2S^3}{CLS^2} - \frac{CL^2S^3}{CLS^2}\right)I_2$$

$$\frac{V_s(s)}{V_e(s)} = \frac{CS^2 LS}{RCSR_p + R + RCLS^2 + LCS^2R_p + LS + \cancel{CL^2S^3} - \cancel{CL^2S^3}} \cdot \frac{1}{CS} \cdot \frac{1/2}{1/2}$$

$$\frac{V_s(s)}{V_e(s)} = \frac{LS}{RCSR_p + R + RCLS^2 + CLS^2R_p + LS}$$

$$\frac{V_s(s)}{V_e(s)} = \frac{LS}{(RCL + R_pLC)S^2 + (RR_pC + L)S + R}$$

Error en estado estacionario a rampa...

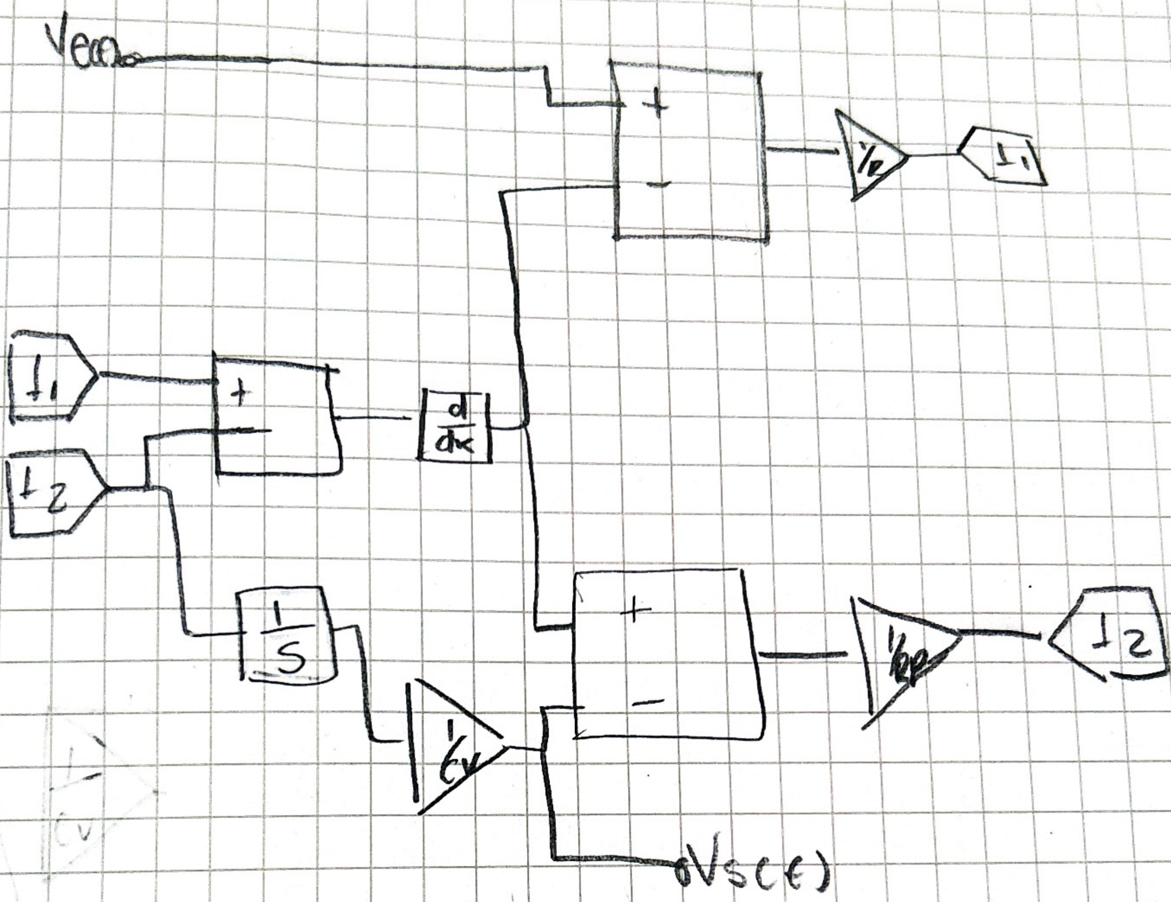
Estabilidad en lazo abierto

Modelo integro-diferencial

$$I_1 = \left(+V_e(t) - \frac{L\, d(I_1 - I_2)}{dt}\right) \cdot \frac{1}{R}$$

$$I_2 = \left(\frac{L\, d(I_1 - I_2)}{dt} - \frac{1}{C_v}\int I_2\, dt\right)\frac{1}{R_p}$$

$$V_s(t) = \frac{1}{C_v}\int I_2\, dt$$



Ve(t)
+
−
1/R
I1
I1
+
−
I2
d/dt
1/S
1/Cv
+
−
1/Rp
I2
Vs(t)

Estabilidad en lazo abierto

$$\frac{Vs(s)}{Ve(s)} = \frac{Ls}{(RCL+RPLC)s^2 + (RRPC+L)s + R}$$

$a = RCL + RPLC$
$b = RRPC + L$
$C = R$

Control
$R = 500\Omega$ $L = 500H$
$RP = 1000\Omega$ $C = 1e^{-3}$

$$\lambda_1 y_2 = \frac{-(RRPC+L) \pm \sqrt{(RRPC+L)^2 - 4(RCL+RPL)(R)}}{2(RCL+RPL)}$$

$a = 750$
$b = 1000$
$C = 500$

$$\lambda_1 y_2 = \frac{-(1000) \pm \sqrt{(1000)^2 - 4(750)(500)}}{2(750)}$$

$$\lambda_1 y_2 = \frac{-1000 \pm \sqrt{-500000}}{1500}$$

$$\lambda_1 = \frac{-1000 + \sqrt{-500000}}{1500} \qquad \lambda_2 = \frac{-1000 - \sqrt{-500000}}{1500}$$

Sistema marginalmente estable

Error en estado estacionario

$$e(s) = \lim_{s \to 0} S \frac{9}{(RCL + Rp\cancel{L}C)s^2 + (RRp\cancel{C} + L)\cancel{s} + R} \cdot \frac{\cancel{1}}{\cancel{s}}$$

$$e_{ss} = \cancel{S}\,\frac{1}{\cancel{S}} + \left[\frac{0}{R}\right]$$

$$e_{ss} = \frac{1}{\cancel{R}}$$